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INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)


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| Applicant's or agent's file reference P26796PC00/HSE | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416) | |
| International application No. PCT/NL 03/00528 | International filing date (day/month/year) 17.07.2003 | Priority date (day/month/year) 26.07.2002 |
| International Patent Classification (IPC) or both national classification and IPC H02H3/12 | | |
| Applicant SPAARSTEKKER B.V. et al. | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 8 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

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| Date of submission of the demand 09.02.2004 | Date of completion of this report 01.10.2004 |
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**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/NL 03/00528

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

2-26 as originally filed
1 filed with telefax on 25.08.2004

Claims, Numbers

1-33 filed with telefax on 25.08.2004

Drawings, Sheets

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/NL 03/00528**

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | |
|-------------------------------|-------------|------------------|
| Novelty (N) | Yes: Claims | 5-17,19-21,28-33 |
| | No: Claims | 1-4,18, 22-27 |
| Inventive step (IS) | Yes: Claims | 5,6,28,29 |
| | No: Claims | 1-4,7-27,30-33 |
| Industrial applicability (IA) | Yes: Claims | 1-33 |
| | No: Claims | |

2. Citations and explanations

see separate sheet

1. In the written opinion an objection was raised that the wording of originally filed claim 1 is so broad and general that it can also be read onto a **switched mode power supply** (SMPS).

In detail, one known type of control of known step-down or buck converters is the **discontinuous current control mode**, i.e. dependent on the current consumption by a load, whereby the current passes from the mains via a switching element and a coil to the load. The output voltage and the load current are measured to determine the switch on/off-times of the switching transistor which is equivalent to bringing **or** holding the switching element into **or** in the open **or** closed state based on said criterion.

Note, the criterion mentioned in features c) - e) of claim 1 is not defined.

Such SMPSs also serve the purpose of reducing the overall energy consumption of an electrical consumer as stated in the application on page 2, lines 35/36.

- 1.1 The applicant states in his letter of reply, dated 25.08.04, that a SMPS provides electrical power to the load at any time. Said electrical power is alternately provided from an external power supply and an internal power supply, whereby an intermediate circuit serves as an energy buffer.

The switching unit according to the present invention, however, switches between supplying electrical power and not supplying power from an external power supply.

The applicant amended the corresponding feature in claim 1, lines 9-12, which now reads as follows (the features added by the applicant with the aim to overcome the examiner's objection are underlined):

a switching element for producing a substantially conductive electrical connection between the mains port and the load port in its closed state for supplying electrical power to the load and substantially breaking the said electrical connection in its open state for interrupting electrical power supply to the load.

- 1.2 Said step-down or buck converters, however, do not have any intermediate circuit for storing energy at an intermediate voltage. The switching element of these converters is controlled such that it switches between supplying electrical power and not supplying power from an external power supply to the load.
- 1.3 Hence, independent claims 1 and 22 do not fulfil the requirement of novelty.
- 1.4 Similarly, the subject-matters of dependent claims 2-4, 18, 23-27 are defined so broadly that the features of said step-down converter can be read onto these

claims.

Therefore, these claims also lack novelty, at least they are not based on the exercise of an inventive step.

2. The applicant did not restrict the claims such that by the addition of structural features and corresponding steps the switching unit and method according to the invention is novel and implies an inventive step with regard to the above discussed SMPs, in particular step-down converters driven in the discontinuous current control mode.

The subject-matter of claim 5 (and/or claim 6) and corresponding claim 28 (and/or claim 29) is considered to be novel and inventive.

The features of remaining dependent claims 7-17, 19, 21 and 30-33 are considered to represent merely one of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to solve the problem posed.

These claims, hence, do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step.

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SWITCHING UNIT FOR SWITCHING A CONNECTION BETWEEN A MAINS AND A LOAD

<for supplying electrical power to the load>
<<for interrupting electrical power supply to the load>>

- 5 The invention relates to a switching unit for switching a connection between a mains and a load, comprising a mains port for electrically connecting the switching unit to the mains, a load port for electrically connecting the switching unit to the load, a switching element for producing a substantially
- 10 conductive electrical connection between the mains port and the load port in its closed state^{<->} and substantially breaking the said electrical connection in its open state^{<->}, and current measuring means for measuring a consumption current consumed by the load.
- 15 Furthermore, the invention relates to a method for switching a connection between a load and a mains, the load being connected to the mains via a switching element for the purpose of producing a substantially conductive electrical connection between the load
- 20 and the mains in a closed state of the switching element^{<->} and substantially breaking the said electrical connection in an open state of the switching element^{<->}.

The invention also relates to an electrical appliance comprising a switching unit of this type^{<->} and to the use of a switching unit

25 ~~of this type~~.

Electrical appliances having a no-load state, such as appliances with a mains adapter which are provided with current via the mains adapter or appliances which have a standby function, are

30 known. Examples of such appliances include notebooks, personal computers, battery chargers, halogen lighting, audio and video equipment, electric blankets, printers and other computer peripherals, as well as many other devices. The appliances may be provided with a separate mains adapter for converting a mains

35 voltage from, for example, a grid mains into, for example, a low voltage. It is also possible for the appliances to be provided with an inbuilt power supply and for the appliance to have a standby state in which the appliance is in the no-load state.

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<for supplying electrical power to the load>
CLAIMS <<for interrupting electrical power supply to the load>>

1. Switching unit for switching a connection between a mains and a load, comprising:
- 5 a mains port for electrically connecting the switching unit to the mains,
a load port for electrically connecting the switching unit to the load,
a switching element for producing a substantially conductive
10 electrical connection between the mains port and the load port in its closed state and substantially breaking the said electrical connection in its open state, and
current measuring means for measuring a consumption current consumed by the load, characterized in that the switching unit
15 comprises control means which are connected to the switching element, the control means comprising:
- (a) means for at least temporarily bringing the switching element into its closed state;
(b) means for measuring a consumption current consumed by the
20 load in the at least temporarily closed state of the switching element;
(c) means for checking the measurement on the basis of a criterion;
(d) means for bringing or holding the switching element into or
25 in the open state if the measurement does not satisfy the criterion; and
(e) means for bringing or holding the switching element into or in the closed state if the measurement does satisfy the criterion.
- 30
2. Switching unit according to claim 1, characterized in that the means mentioned under (c) comprise means for comparing the measured value of the consumption current with a threshold value, and
35 the means mentioned under (e) comprise means for closing the switching element or holding it in the closed state if the measured value of the consumption current is greater than or equal to the threshold value.

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3. Switching unit according to claim 1, characterized in that the means mentioned under (c) comprise means for comparing the measured value of the consumption current with a threshold value, and

5 the means mentioned under (d) comprise means for bringing the switching element into the open state if the measured value of the consumption current is lower than the threshold value.

10 4. Switching unit according to claim 2 or 3, characterized in that the threshold value comprises a value for a no-load consumption current.

5. Switching unit according to claim 4, characterized in that the control means also comprise:

15 means for using the current measuring means to measure a consumption current for a load which has been brought into a no-load state, and means for storing the measured value of the consumption current as a no-load consumption current in a memory which is accessible to the switching unit.

20 6. Switching unit according to claim 5, characterized in that the control means comprise means for adding a margin value to the value for the no-load consumption current.

25 7. Switching unit according to one of claims 1-6, characterized in that the switching unit comprises voltage measuring means for measuring a mains voltage applied to the mains port, in that the switching element comprises a self extinguishing semiconductor switch, and in that the control means
30 comprise control pulse generation means for generating a control pulse for the self extinguishing semiconductor switch as a function of an instantaneous value of the mains voltage measured by the voltage measuring means.

35 8. Switching unit according to claim 7, characterized in that the control pulse generation means are also designed to generate a repeating pulse train, a repetition frequency of which corresponds to double a repetition frequency of the mains

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voltage, for the purpose of holding the self extinguishing semiconductor switch in the closed state.

9. Switching unit according to claim 8, characterized in that the control pulse generation means are also designed to shorten a pulse duration of the control pulses after the end of a turn-on time starting from the switching element reaching the closed state.

10. Switching unit according to one of claims 7-9, characterized in that the control pulse generation means are designed to generate a control pulse in the open state of the switching element just before a zero crossing of the mains voltage, for the purpose of bringing the switching element into a closed state during a measurement time.

11. Switching unit according to one of the preceding claims, characterized in that the control means comprise a first and a second supply voltage terminal for creating a supply voltage between these terminals at the control means, the first supply voltage terminal being connected to a terminal of the switching element which is connected to the mains port and the second supply voltage terminal being connected to a terminal of the switching element which is connected to the load port.

12. Switching unit according to claim 11, characterized in that the switching element comprises a voltage drop element for causing a voltage drop across the switching element in operation when the switching element is in the closed state.

13. Switching unit according to one of the preceding claims, characterized in that the switching unit comprises a male plug connector unit for electrically connecting the mains port to a mains wall socket unit, and a female plug connector for electrically connecting the load port to a male plug connector which is connected to the load.

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14. Switching unit according to one of the preceding claims, characterized in that the switching unit is accommodated in the load.
- 5 15. Switching unit according to one of the preceding claims, characterized in that the switching unit comprises a communications port for transmitting data from or to the control means.
- 10 16. Switching unit according to claim 15, characterized in that the communications port comprises a wireless connection.
- 15 17. Switching unit according to claim 15 or 16, characterized in that the communications port comprises a terminal for connecting the switching unit to a data-processing system.
- ~~20~~
~~49~~ 20. Electrical appliance comprising a switching unit according to one of claims 1-17. *[[for supplying electrical power to the load]]*
[[for interrupting electrical power supply to the load]]
- 20 ~~22~~
~~22~~ 22. Method for switching a connection between a load and a mains, the load being connected to the mains via a switching element for the purpose of producing an electrical connection between the load and the mains in a closed state of the switching element ²² and substantially breaking the said electrical connection ²² in an open state of the switching element, characterized by the steps of:
- 25 (a) at least temporarily bringing the switching element into the closed state;
- (b) measuring a consumption current consumed by the load in the at least temporarily closed state of the switching element;
- 30 (c) checking the measurement against a criterion;
- (d) bringing or holding the switching element into or in the open state if the measurement does not satisfy the criterion; and
- (e) bringing or holding the switching element into or in the closed state if the measurement does satisfy the criterion.
- 35 23
~~20~~ 23. Method according to claim ²² 19, characterized in that, if the switching element is in the open state, step (c) comprises the step of

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comparing the measured value of the consumption current with a threshold value; and

step (e) comprises the step of

closing the switching element or holding the switching element in the closed state if the measured value of the consumption current is greater than or equal to the threshold value.

²⁴
~~24~~. Method according to claim ²³~~24~~, characterized by repeating steps (a), (b), (c) and (d) if the measured value of the consumption current is lower than the threshold value.

²⁵
~~27~~. Method according to claim ²²~~27~~, characterized in that, if the switching element is in the closed state, step (c) comprises the step of

comparing the measured value of the consumption current with a threshold value; and

step (d) comprises the step of

bringing the switching element into the open state if the measured value of the consumption current is lower than the threshold value.

²⁶
~~27~~. Method according to claim ²⁵~~27~~, characterized by repeating steps (b), (c) and (e) if the measured value of the consumption current is greater than or equal to the threshold value for one or more of a predetermined number of repetitions, the switching element being moved into the open state if the measured value of the consumption current is lower than the threshold value for the predetermined number of repetitions.

²⁷
~~24~~. Method according to one of claims ²³⁻²⁶~~20-29~~, characterized in that the threshold value comprises a value of a no-load consumption current.

²⁸
~~27~~. Method according to claim ²⁷~~24~~, characterized in that the method comprises the initial steps of:

(f) bringing the load into a no-load state;

(g) bringing the switching element into the closed state;

(h) measuring the consumption current;

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(i) storing the measured value of the consumption current as a no-load consumption current in a memory which is accessible to the switching unit.

- 5 ²⁹~~28~~. Method according to claim ²⁸~~29~~, characterized in that step (i) also comprises the step of:
adding a margin value to the value of the no-load consumption current.

- 10 ³⁰~~29~~. Method according to claim ²⁷~~28~~, characterized in that the method also comprises the steps of:
comparing the measured value of the consumption current with the value for the no-load consumption current;
storing the measured value of the consumption current as a no-
15 load consumption current in a memory which is accessible to the switching unit if the measured value of the consumption current is lower than the no-load consumption current.

- 20 ³¹~~30~~. Method according to one of claims ²²⁻³⁰~~29-30~~, characterized in that the method also comprises the steps of:
comparing the measured value of the consumption current with a maximum value; and
opening the switching element if the measured value of the consumption current is greater than the maximum value.

- 25 ³²~~31~~. Method according to one of claims ²³⁻³¹~~22-31~~, characterized in that step (b) takes place with a repetition period which is an integer multiple of a repetition period of the mains voltage.

- 30 ³³~~32~~. Method according to one of claims ²³⁻³²~~22-32~~, characterized in that the steps (a) and (b) comprise the steps of:
repeatedly or continuously measuring an instantaneous value for the mains voltage;
closing the switching element between two successive zero
35 crossings of the mains voltage;
measuring the consumption current; and
opening the switching element.

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21 <-> comprising
22. ~~the~~ ^{to} the switching unit according to one of claims 1-17
~~for powering a battery charged.~~

18 <->
23. ~~the~~ ^{to} the switching unit according to one of claims 1-17
5 ~~for providing~~ a supply voltage to and/or ^{to} interrupting a supply
voltage for a load at at least one predetermined time.

19 <->
24. ~~the~~ ^{to} the switching unit according to one of claims 1-17
10 ~~for providing~~ a supply voltage to and/or ^{to} interrupting a supply
voltage for a load in response to an external signal.

<<configured to>>

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